

LUNAR DEVELOPMENT & TEST FACILITY, JSC B351

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Introduction:

In anticipation of extended operations on the lunar surface, JSC Building B351 has been prepared to meet test needs to mature technologies that extract resources from lunar regolith, handle lunar regolith or must perform in a dusty lunar environment. Domains such as In-Situ Resource Utilization (ISRU), dust mitigation, power generation and distribution, robotics and surface tools will all require testing with lunar regolith/simulants to demonstrate flight readiness. The Lunar Development and Test Facility (LDTF) houses environmental test capabilities, including lunar simulants, geared toward advancing Technical Readiness Level (TRL) of these lunar surface technologies. Seen as an agency need to enable and demonstrate new technologies, a portion of the facility capability was developed under the “Dirty Lunar Surface Simulation” project in FY2020, funded by the NASA Game Changing Development program. Some current uses include testing of an oxygen extraction from lunar regolith test, a spacesuit cleaning tool evaluation and a study to measure dust effects on space radiators (thermal management).

Facility capabilities include a Simulant Preparation Area, Settling dust chamber, Component TVAC chamber, Dusty Glove Box and a 15ft thermal vacuum chamber. A majority of the lunar simulant handling is done in the Simulant Preparation Area (Fig 1). This area is equipped with particle monitoring, HEPA filtering and operational protocols to safely perform simulant handling. In this area, simulants can be dried or mixed to desired water /simulant ratio (for icy-regolith).



Fig 1- Simulant Preparation area (left), Settling Dust Chamber (right)

Also located in the area is a Settling dust chamber (Fig 1). This is an ambient pressure capability that dusts and re-dusts components with lunar simulant at designated intervals. This is especially helpful for moving

test articles that need dust reapplied to maintain a specific level of dust accumulation on it.

Large beds or drill tubes are also prepared in the Simulant prep area (Fig 2). Any mixing and compaction is done in this room prior to loading in the 15ft thermal vacuum chamber.

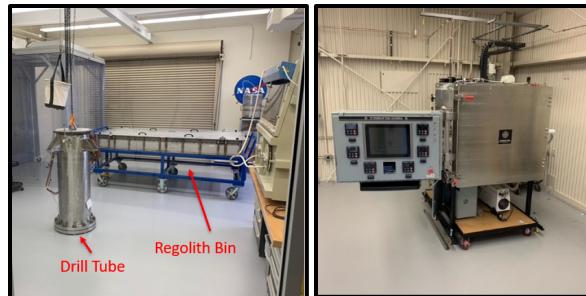


Fig 2- Chamber Drill Tube and Regolith Bin in Simulant Prep Area (left), Component TVAC (right)

Component level environment testing with dust can be performed in the 3ft vacuum chamber (cube). The chamber is capable of vacuum levels down to 10^{-6} torr and has zoned controlled shroud walls capable of temperatures ranging from -300°F to +300°F.

15ft thermal chamber is used for sub-system and system level testing (Fig 3). Originally built to test fuel cells and later used for high energy batteries. The chamber was upgraded with dust mitigation for its vacuum system to allow for testing with dust and/or regolith beds. The chamber is capable of 10^{-6} torr and shroud range of -300°F to +250°F.



Fig 3- 15ft Thermal Vacuum Chamber with Spacesuit dust mitigation test equipment installed